



GDG 2CC EXTRACIRICULAR PROJECT REPORT

TOPIC :

Find the details of people who are currently on the International Space Station and mark the current position of the ISS overhead Earth's map.

ARCHIT KUMAR- 16BCE0468

archit.kumar2016@vitstudent.ac.in

TOPIC SELECTED (PYTHON PROJECT):

TITLE : Find the details of people who are currently on the International Space Station and mark the current position of the ISS overhead Earth's map.

DESCRIPTION :

API: for name of astronauts on ISS - <http://api.opennotify.org/astros.json>

API to find position of ISS real time <http://api.open-notify.org/iss-now.json>

Implementation of plotting of latitude and longitude fetched from API to be done with reference to <https://matplotlib.org/basemap/users/examples.html>

ABSTRACT:

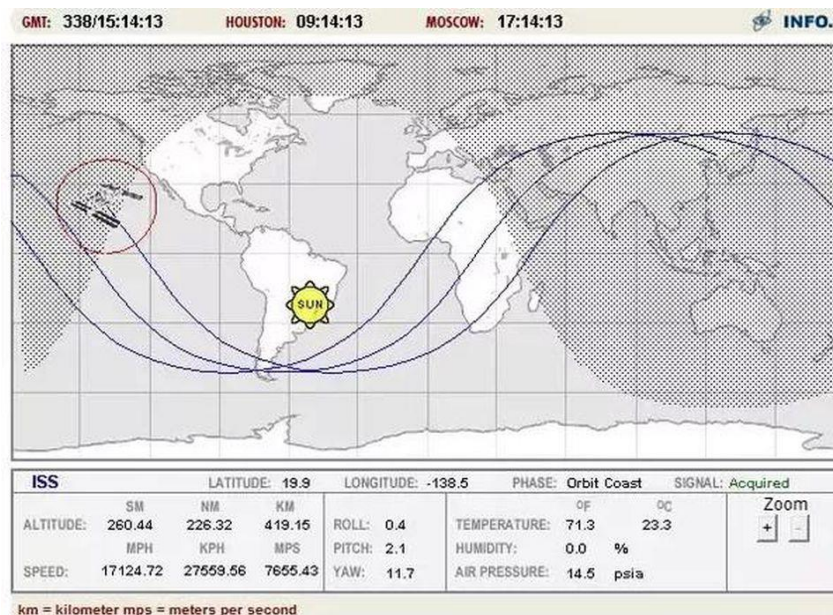
The main objective of this project is to find the people who are currently present in the International Space Station also to determine the exact positional latitude and longitude of the International Space Station and to plot the exact positional coordinates on a world map using base map Python library.

Introduction

The ISS revolves around the Earth at about 17,500 mph (~28,000 km/h) resulting in it completing one revolution in about 90 minutes, and about 16 revolutions per day. The ISS rotates about its center of mass at a rate of about 4 degrees per minute so that it will complete a full rotation once per orbit.

This allows it to keep its belly towards the Earth. Because the Earth is rotating, the ISS doesn't pass over the same places on Earth each orbit

ISS – TRAJECTORY:

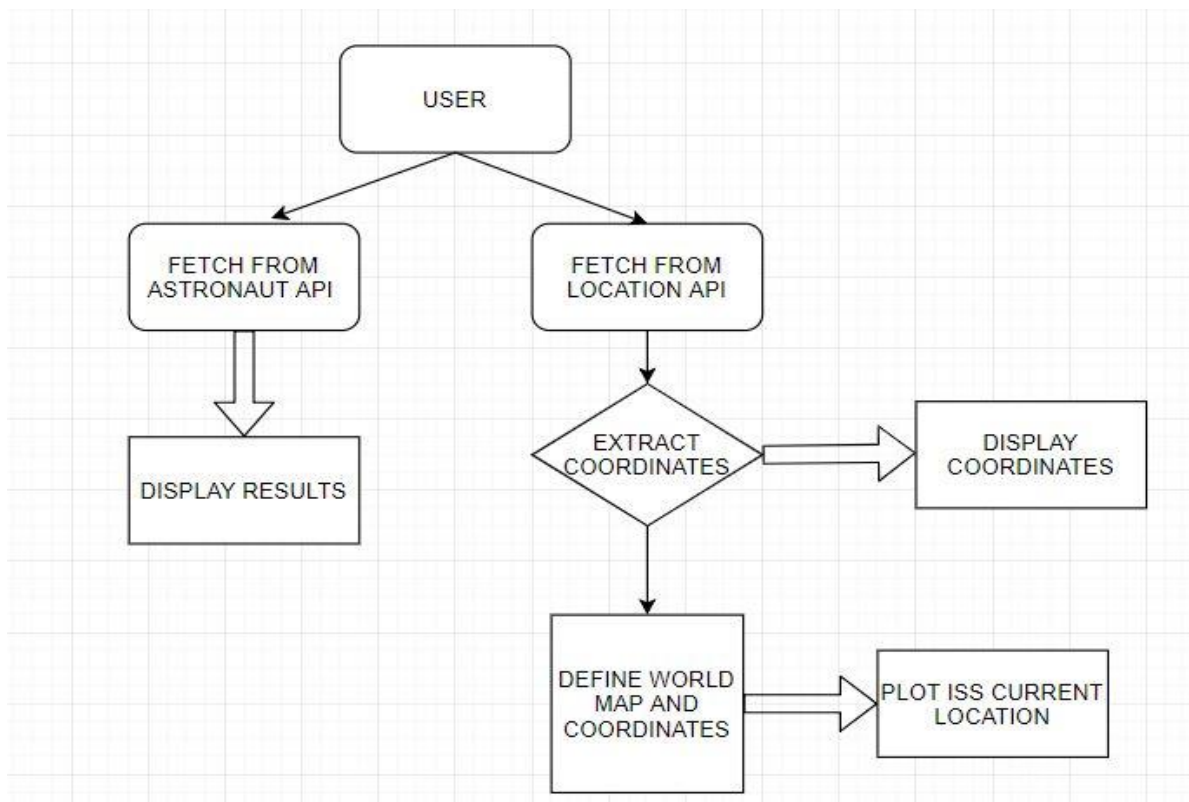


METHODOLOGY

Basic Concept :

The required information will be extracted using the API using the libraries Json and URL library request using python .The information will be correctly extracted using the tags and will be displayed the positions and as well as the list of astronauts. For plotting the position Python matplotlib libraries are used specifically the base map library for plotting the current position of the ISS .

The Block Diagram:



SOURCE CODE BEING IMPLEMENTED:

```
import json
import urllib.request
url2 = 'http://api.open-notify.org/iss-now.json'
response2 = urllib.request.urlopen(url2)
r2 = json.loads(response2.read())
print("JSON RESULT Obtained : ")
print(r2)
url = 'http://api.open-notify.org/astros.json'
response = urllib.request.urlopen(url)
r1 = json.loads(response.read())
print("JSON RESULT Obtained : ")
print(r1)
print('People Currently in Space: ', r1['number'])
everyone = r1['people']
for p in everyone:
    print(p['name'])
```

```

location = r2['iss_position']
lat1 = location['latitude']
lon1 = location['longitude']
print('Latitude: ', lat1)
print('Longitude: ', lon1)

import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.basemap import Basemap
from itertools import chain
def draw_map(m, scale=0.2):
    m.shadedrelief(scale=scale)
    lats = m.drawparallels(np.linspace(-90, 90, 13))
    lons = m.drawmeridians(np.linspace(-180, 180, 13))
    lat_lines = chain(*(tup[1][0] for tup in lats.items()))
    lon_lines = chain(*(tup[1][0] for tup in lons.items()))
    all_lines = chain(lat_lines, lon_lines)
    for line in all_lines:
        line.set(linestyle='-', alpha=0.3, color='w')
fig = plt.figure(figsize=(8, 6), edgecolor='w')
m = Basemap(projection='cyl', resolution=None,
llcrnrlat=-90, urcrnrlat=90,
llcrnrlon=-180, urcrnrlon=180, )
draw_map(m)
location = r2['iss_position']
lat1 = location['latitude']
lon1 = location['longitude']
plt.plot(float(lat1), float(lon1), 'ok', markersize=3)
plt.text(float(lat1), float(lon1), 'ISS Location', fontsize=12);
print("CURRENT POSITIONAL COODRINATES")
print("LATITUDE ", lat1)
print("LONGITUTUDE ", lon1)
print("CURRENT POSITION ON THE WORLD MAP")

```

API USED:

ISS ASTRONAUTS API : <http://api.open-notify.org/astros.json>

ISS LOCATION API : <http://api.open-notify.org/iss-now.json>

JUPYTER NOTEBOOK IMPLEMENTATION SCREENSHOTS :

```
In [1]: import json
import urllib.request
```

```
In [2]: url = 'http://api.open-notify.org/astros.json'
response = urllib.request.urlopen(url)
r1 = json.loads(response.read())
print("JSON RESULT Obtained : ")
print(r1)
```

```
JSON RESULT Obtained :
{'message': 'success', 'number': 6, 'people': [{'craft': 'ISS', 'name': 'Oleg Kononenko'}, {'craft': 'ISS', 'name': 'David Saint-Jacques'}, {'craft': 'ISS', 'name': 'Anne McClain'}, {'craft': 'ISS', 'name': 'Alexey Ovchinin'}, {'craft': 'ISS', 'name': 'Nick Hague'}, {'craft': 'ISS', 'name': 'Christina Koch'}]}
```

```
In [3]: print('People Currently in Space: ', r1['number'])
everyone = r1['people']
for p in everyone:
    print(p['name'])
```

```
People Currently in Space: 6
Oleg Kononenko
David Saint-Jacques
Anne McClain
Alexey Ovchinin
Nick Hague
Christina Koch
```

```
In [4]: url2 = 'http://api.open-notify.org/iss-now.json'
response2 = urllib.request.urlopen(url2)
r2 = json.loads(response2.read())
print("JSON RESULT Obtained : ")
print(r2)
```

```
JSON RESULT Obtained :
{'iss_position': {'latitude': '-28.5191', 'longitude': '179.3194'}, 'timestamp': 1553449274, 'message': 'success'}
```

```
In [5]: location = r2['iss_position']
lat1 = location['latitude']
lon1 = location['longitude']
print('Latitude: ', lat1)
print('Longitude: ', lon1)
```

```
Latitude: -28.5191
Longitude: 179.3194
```

```
In [6]: import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.basemap import Basemap
```

```
In [7]: from itertools import chain

def draw_map(m, scale=0.2):
    m.shadedrelief(scale=scale)

    lats = m.drawparallels(np.linspace(-90, 90, 13))
    lons = m.drawmeridians(np.linspace(-180, 180, 13))

    lat_lines = chain(*(tup[1][0] for tup in lats.items()))
    lon_lines = chain(*(tup[1][0] for tup in lons.items()))
    all_lines = chain(lat_lines, lon_lines)

    for line in all_lines:
        line.set(linestyle='-', alpha=0.3, color='w')
```

```
In [25]: fig = plt.figure(figsize=(8, 6), edgecolor='w')
m = Basemap(projection='cyl', resolution=None,
            llcrnrlat=-90, urcrnrlat=90,
            llcrnrlon=-180, urcrnrlon=180, )
draw_map(m)
location = r2['iss_position']
lat1 = location['latitude']
lon1 = location['longitude']
plt.plot(float(lat1), float(lon1), 'ok', markersize=3)
plt.text(float(lat1), float(lon1), 'ISS Location', fontsize=12);
print("CURRENT POSITIONAL COORDINATES")
print("LATITUDE ", lat1)
print("LONGITUDE ", lon1)
print("CURRENT POSITION ON THE WORLD MAP")
```

```
CURRENT POSITIONAL COORDINATES
LATITUDE -41.2741
LONGITUDE -52.2477
CURRENT POSITION ON THE WORLD MAP
```



STEP BY STEP IMPLEMENTATION:

```
import json
import urllib.request
```

#The above modules are imported in python

```
url2 = 'http://api.open-notify.org/iss-now.json'
response2 = urllib.request.urlopen(url2)
r2 = json.loads(response2.read())
print("JSON RESULT Obtained : ")
print(r2)
```

*#Using the URLLIB request sent to the specified API the response is stored in variable r2 using
#JSON library function which is converted into a dictionary which contains the position i.e the
latitude and longitude of the ISS.*

```
url = 'http://api.open-notify.org/astros.json'
response = urllib.request.urlopen(url)
r1 = json.loads(response.read())
print("JSON RESULT Obtained : ")
print(r1)
```

*#Using the URLLIB request sent to the specified API the response is stored in variable r1 using
#JSON library function which is converted into a dictionary which contains the list of the
#astronauts in the ISS.*

```
print('People Currently in Space: ', r1['number'])
everyone = r1['people']
for p in everyone:
    print(p['name'])
```

#the list of astronauts is printed by extracting json element tag

```
location = r2['iss_position']
lat1 = location['latitude']
lon1 = location['longitude']
print('Latitude: ', lat1)
print('Longitude: ', lon1)
```


#the current coordinates(latitude and longitude) of the ISS is printed by extracting jthe respective json element tag .

```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.basemap import Basemap
```

#The above modules are imported in python

Basemap is imported .Basemap is a great tool for creating maps using python in a simple way.

```
from itertools import chain
```

```
def draw_map(m, scale=0.2):
    m.shadedrelief(scale=scale)

    lats = m.drawparallels(np.linspace(-90, 90, 13))
    lons = m.drawmeridians(np.linspace(-180, 180, 13))

    lat_lines = chain(*(tup[1][0] for tup in lats.items()))
    lon_lines = chain(*(tup[1][0] for tup in lons.items()))
    all_lines = chain(lat_lines, lon_lines)

    for line in all_lines:
        line.set(linestyle='-', alpha=0.3, color='w')
```

#draw_map function is defined to draw the world map along with the latitude and the longitude lines .All the latitude and longitude lines are evenly spaced according to the 2D dimensional World map image meridians and parallels are drawn.

```
fig = plt.figure(figsize=(8, 6), edgecolor='w')
m = Basemap(projection='cyl', resolution=None,
            llcrnrlat=-90, urcrnrlat=90,
            llcrnrlon=-180, urcrnrlon=180, )
draw_map(m)
location = r2['iss_position']
lat1 = location['latitude']
lon1 = location['longitude']
plt.plot(float(lat1), float(lon1), 'ok', markersize=3)
plt.text(float(lat1), float(lon1), ' ISS Location' , fontsize=12);
print("CURRENT POSITIONAL COODRINATES")
print("LATITUDE ", lat1)
print("LONGITUTUDE ", lon1)
```

```
print("CURRENT POSITION ON THE WORLD MAP")
```

#The world map is printed using a cylindrical collection attribute the latitude is defined from - 90 #to + 90 and the longitude is defined from - 180 to + 180.

#The location of the latitude and the longitude is extracted from the location based on attribute #and the current position of the ISS is marked on the figure of the map that is plotted

RESULT:

FOR the Code Implemented at 3/24/2019 22 : 45 IST

The Json Data Obtained for astronauts is:

```
JSON RESULT Obtained : {'message': 'success', 'number': 6, 'people':  
[{'craft': 'ISS', 'name': 'Oleg Kononenko'}, {'craft': 'ISS', 'name':  
  'David Saint-Jacques'}, {'craft': 'ISS', 'name': 'Anne McClain'},  
{'craft': 'ISS', 'name': 'Alexey Ovchinin'}, {'craft': 'ISS', 'name':  
  'Nick Hague'}, {'craft': 'ISS', 'name': 'Christina Koch'}]}
```

The Json Data Obtained for position is:

```
JSON RESULT Obtained : {'iss_position': {'latitude': '-28.5191',  
'longitude': '179.3194'}, 'timestamp': 1553449274, 'message': 'success'}
```

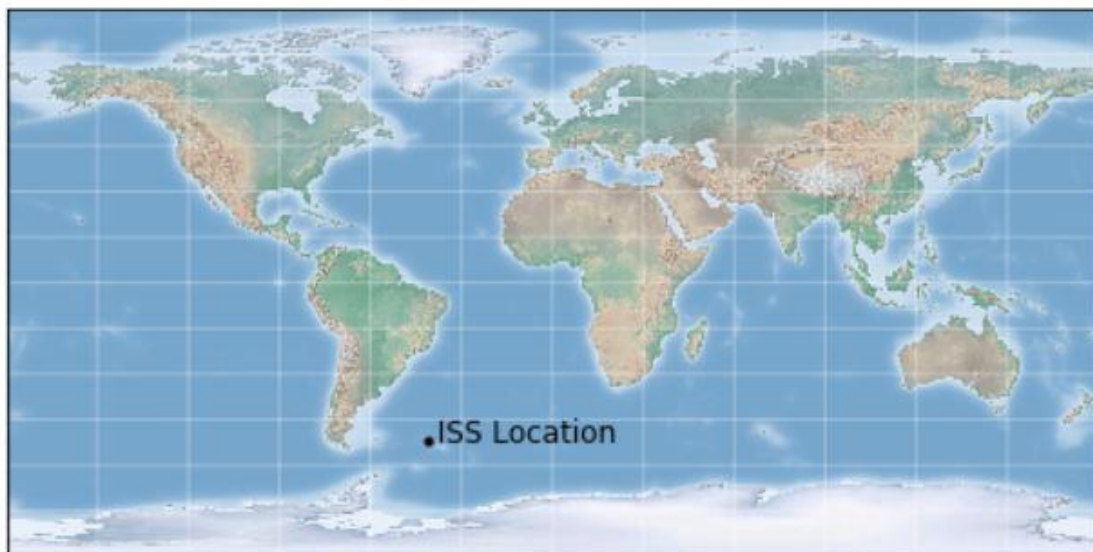
The MAP PLOT For the Position:

CURRENT POSITIONAL COODRINATES

LATITUDE -41.2741

LONGITUTUDE -52.2477

CURRENT POSITION ON THE WORLD MAP



CONCLUSION:

Hence the data of astronauts currently aboard the ISS is successfully obtained using the given API and URL library Also the position coordinates of the ISS in real-time are obtained also the position of ISS is plotted on the world map depicting its current location.

References:

<https://www.forbes.com/sites/quora/2017/10/03/how-does-the-iss-travel-around-the-earth/#3845e5b141f2>

<https://github.com/Microsoft/AzureNotebooks/issues/554>

<https://matplotlib.org/basemap/>

<https://basemaptutorial.readthedocs.io/>

<https://jakevdp.github.io/PythonDataScienceHandbook/04.13-geographic-data-with-basemap.html>

<https://github.com/matplotlib/basemap>

<https://pythonprogramming.net/basemap-customization-matplotlib-tutorial/>

https://en.wikipedia.org/wiki/International_Space_Station

<https://spotthestation.nasa.gov/sightings/>

<http://www.isstracker.com/>

<https://www.forbes.com/sites/quora/2016/05/23/why-does-the-iss-orbit-so-close-to-earth/>